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REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

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THE LATE

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ZOOLOGY—VOL. XXIII.

PART LXXI.—REPORT ON THE ENTOZOA

BY DR. O. VON LINSTOW

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EDITORIAL NOTE.

HAD any special attention been paid to collecting ENTOZOA during the Expedition, a much larger number of species would probably have been obtained than are described in this short but valuable Report by Dr. O. von Linstow of Göttingen, one of the first authorities on this group of animals. The Report consists of 18 pages of letterpress, 2 lithographic plates and a woodcut. The translation from the German was made by Mr. J. Arthur Thomson, M.A. The Manuscript was received by me on the 24th October 1887.

JOHN MURRAY.

CHALLENGER OFFICE, 32 QUEEN STREET,
EDINBURGH, *9th May* 1888.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the ENTOZOA collected by H.M.S. Challenger during the Years 1873-76. By Dr. O. VON LINSTOW of Göttingen.

INTRODUCTION.

THE number of Entozoa included in the spoils of the Challenger Expedition is remarkably small in comparison with the large collection of Vertebrates. This is mainly due to the fact that the exploration was for the most part marine, and not terrestrial, and that it concerned not only the regions near the coast, but also to a very large extent the deep sea. For it follows from the nature of the life-history of Helminths, that these forms must occur more and more sparsely in proportion to the distance from the shore. In the Nematoda, Gordiacea, Acanthocephala, Trematoda, and Cestoda, with few exceptions (among Nematodes and Trematodes), the sexually mature forms are parasitic in some organ, such as the stomach, which communicates with the outer world, and from which the numerous eggs pass out with the excrement. On the soil or in the water the ova find their way into another organism, within which they develop into larvæ, and are usually encapsuled until they pass along with their intermediate host into the original victim, where they become sexually mature. Not a few Helminths, such as many digenetic Trematodes and the Gordiaceæ, have in their developmental cycle to pass through two intermediate hosts. That the Vertebrata which inhabit the high seas are remarkably free from Helminths is without doubt due to the fact that the ova are too widely scattered in the infinite mass of water to have much chance of reaching their proper intermediate hosts; and, further, that even when they do so, there is again in the

wide ocean but a slight chance that infected intermediate hosts become the prey of the final victims.

The Acanthocephala, Gordiacea, and Trematoda are altogether unrepresented in the Challenger collection. The absence of the first is perhaps only accidental; while the Gordiacea are entirely fresh-water forms, and the Trematodes are, as free-swimming larvæ, too delicate to withstand the pressure of a deep-sea life, and are restricted either to quiet fresh-water basins or to sheltered littoral regions.[1]

A. NEMATODA.

1. *Ascaris simplex*, Rudolphi (*non* Dujardin) (Pl. I. figs. 1–4).

Specimen labelled: "Ascaris from stomach of *Otaria jubata*, January 27, 1874. Kerguelen Island."

The vessel contained thirteen specimens, of which the largest was 79 mm. long and 2·2 mm. broad. The upper lip is semicircular, with an anterior protrusion; the pulp sends two cylindrical protrusions into the latter, and these are rounded off anteriorly; the anterior end bears a dentigerous ridge with pointed teeth; there are no accessory lips; the upper lip (0·12 mm. across) is much smaller than the two under lips (0·30 mm.). The cuticle exhibits transverse wrinkles (0·023 mm. in breadth), between which there are again finer markings about eight times as narrow. The lateral areas are 0·23 mm. in breadth, the dorsal and ventral regions measure 0·035 mm. The male is 37 mm. in length, and 0·9 mm. in breadth; the tail bears on each side of the very extremity four conical papillæ; two or three others of a round form occur just in front of the cloaca; at each side of these six others shortly stalked, and again in front an inconstant row of fifty or more. Krabbe has given a good representation of the posterior end of the male, in which the long cirri (1·68 mm. in length) are seen to exhibit a sabre-shaped curvature. In the female, which measures 79 mm. in length, and 2·2 mm. in breadth, the anus is situated at a distance of 0·48 mm. from the tail end; the latter is rounded, and bears embedded in the cuticle a small styliform process. The vulva lies somewhat in front of the middle of the body, and the anterior region thus defined bears to the posterior the proportion of three to four. The ova are spherical. The hyaline sheath, separated by a considerable interspace from the large yolk (0·036 mm.) which it surrounds, bears small roundish elevations, and measures 0·052 mm.

Ascaris simplex was first described in a few words by Rudolphi,[2] who discovered it in *Delphinus phocæna* and *Delphinus gangeticus*.

[1] Notices of one Acanthocephalan, two Trematodes (one of which comes from deep water), and some *Gordii* will however, be found in the Appendix.

[2] Entoz. Hist. Nat., Amstelædami, 1808–1810, ii. p. 170; Synopsis, Berolini, 1819, pp. 49, 54, 296.

The opportunity of studying this parasite must indeed be a rare one, since the next naturalist who investigated and described "*Ascaris simplex*" was Dujardin.[1] He described the spicules as unequal, measuring 15 and 27 mm. in length in a specimen 79 mm. long; the ventral surface bore eight to ten papillæ; the female was 100 mm. in length; the ova measured 0·041–0·043 mm.; the vulva was situated far forward, so that the anterior and posterior regions exhibited a proportion of 5 to 12 or 2 to 5. The specimens were found in a Dolphin captured near the Maldives. The enormous length and marked inequality of the cirri, the position of the vulva, the size of the ova, the number of papillæ, all go to prove that the species was not the same as that which we have described above. From the size and inequality of the cirri it may indeed be inferred that the form studied by Dujardin was not an *Ascaris* at all.

Krabbe[2] was the first to distinguish *Ascaris simplex* from the other Ascarids found in Seals and Dolphins; that is to say, from (1) *Ascaris osculata*, Rudolphi, from *Phoca grœnlandica* and *Phoca barbata*, *Halichœrus grypus*, *Cystophora cristata*, and *Trichechus rosmarus*; (2) *Ascaris decipiens*, Krabbe, from *Phoca grœnlandica*, *Phoca barbata*, *Phoca hispida*, *Phoca vitulina*, *Cystophora cristata*, and *Trichechus rosmarus*; (3) *Ascaris lobulata*, Schneider, from *Platanista gangetica*; (4) *Ascaris conocephala*, Krabbe, from *Delphinus delphis* and *Clymenia*. He described *Ascaris simplex* from *Lagenophrys albirostris*, *Beluga leucas*, *Hyperoodon rostratus*, and *Monodon monoceros*, and figures the upper lip and the posterior extremity of the male.

The *Ascaris patagonica*, which I have described[3] from an *Otaria jubata* captured off Patagonia by Professor Behn on his voyage round the world, is entirely different from *Ascaris simplex*, as a glance at the figure will at once show.

That this parasite, hitherto found only in Dolphins, should occur in *Otaria jubata*, Forster, is somewhat remarkable, as no other case is known of a species infesting both Seals and Cetacea.

2. *Ascaris spiculigera*, Rud. (Pl. I. figs. 5–7).

Specimen labelled: "Ascaris from the stomach of *Phalacrocorax verrucosus*,[4] January 1874, Kerguelen Island (Shag.)."

The vessel contained thirty-eight Nematodes, of which thirty-six belonged to the above species.

The body is short and thick; the smallest specimens, still sexually immature, were 5·44 mm. in length by 0·27 mm. in breadth. The cuticle exhibits regular transverse wrinkles, 0·003 mm. in breadth. The œsophagus measures $\frac{1}{4\cdot3}$, and the tail $\frac{1}{3\cdot5}$ of the total

[1] Histoire des Helminthes, Paris, 1845, pp. 220, 221.
[2] *Kong. dansk. Vidensk. Forh.*, 1878, pp. 47–49, fig. 2, tab. i. fig. 4.
[3] *Archiv f. Naturgesch.*, Jahrg. xlvi. Bd. i., 1880, pp. 41, 42, pl. iii. fig. 1.
[4] Zool. Chall. Exp., vol. ii. pt. viii., *Phalacrocorax verrucosus*, Cab., p. 122.

length of the worm. The intestine leads anteriorly into a diverticulum, which has a distinct lumen, measures 0·78 mm. in length and 0·036 mm. in breadth, and lies anteriorly on the dorsal side of the œsophagus. The œsophagus, lying in the ventral side of the animal, is also continued backwards into a cæcum lying below the intestine, and measuring 1·86 mm. in length by 0·072 mm. in breadth. The lips bear dentigerous ridges, and between them there are accessory lips. The upper lip is quadrangular with rounded anterior angles, it is 0·043 mm. in length and 0·066 mm. broad; the outer surface is flat, the inner gives off two rounded processes, which extend outwards and forwards, and protrude terminally on either side below the outer surface. The accessory lips are hook-shaped and bent inwards; they are but slightly smaller than the principal lips, from which they are markedly distant. The tail end is conical and pointed. The two uniform sabre-shaped cirri of the male are 7·2 mm. long, and are protruded for about 6 mm. They can be recognised with the naked eye, and to this the specific title obviously refers. Of postanal papillæ there are four median, and somewhat towards the ventral surface three lateral, while in front of the anus there is a variable row of thirty-eight to forty or so.

The largest female was 24 mm. long and 1·1 mm. broad. The vulva is situated about the boundary between the first and second quarter of the body, dividing the latter in the proportion of 5 to 13. The ova are spherical, the shell measures 0·0049 mm. in thickness, and is considerably distant from the yolk. It exhibits a very beautiful marking, due to regular, uniformly distributed, minute, shining elevations. The diameter measures 0·072 mm., while that of the yolk is 0·042 mm.

Ascaris spiculigera was first described by Rudolphi,[1] and has been subsequently observed by a great number of naturalists. The hosts are very numerous[2]—*Mergus merganser* and *Mergus serrator*, *Pelecanus americanus*, *Pelecanus onocrotalus*, *Pelecanus tetrarhynchus*, and *Pelecanus fuscus*, *Carbo brasiliensis*, *Carbo cormoranus*, *Carbo cristatus*, *Carbo dilophus*, *Carbo graculus*, and *Carbo pygmæus*, *Plotus anhinga*, *Lestris pomarinus*, *Larus tridactylus*, *Colymbus arcticus*, *Colymbus rufogularis*, and *Colymbus septentrionalis*, *Podiceps auritus*, *Podiceps dominicensis*, and *Podiceps minor*, *Uria troile*, *Alca torda*. The stomach and œsophagus are infested. The best descriptions are those of Dujardin[3] and Schneider.[4] The geographical distribution is remarkably extensive, for the species occurs in Europe (Germany, Scandinavia, Austria, Sardinia, France), in Asia (Turkestan[5]), in Africa, in America (Brazil), and in the Antarctic region.

[1] Entoz. Hist. Nat., Amstelædami, t. ii., 1808–1810, p. 168.

[2] Von Linstow, Compendium der Helminthologie, Hannover, 1878, pp. 162–178.

[3] *Loc. cit.*, pp. 206–208.

[4] Monographie der Nematoden, Berlin, 1866, p. 45, pl. i. fig. 14.

[5] Von Linstow, Fedtschenko's Journey in Turkestan, *Soc. Nat. Hist. Moscow*, sec. 18, vol. ii. pp. 3, 4, 1886 (in Russian).

3. *Ascaris biloba*, n. sp. (Pl. I. figs. 8, 9).

Specimen labelled: "January 1876; Straits of Magellan."

The host is not noted; the vessel contained five specimens, which were immature females, with the ovaries and uteri well developed, but without ova.

The maximum length was 48 mm., the breadth 2·2 mm. The body is rounded off at both ends, and the posterior extremity is the thicker. The cuticle is thick and transversely wrinkled at intervals of 0·14 mm., while between these main markings there is a finer transverse wrinkling, with intervals of 0·006 mm. The musculature is divided by the usual four longitudinal ridges into four longitudinal bands; the dorsal and ventral ridges measure 0·13 mm. in breadth, the two laterals 0·24 mm. The head bears three lips, with dentigerous plates and accessory lips; the upper lip is pentagonal with rounded corners, and is about as long as broad, measuring 0·25 mm. in length and 0·26 mm. in breadth; the base is 0·098 mm. broad. The anterior margin bears a dentigerous plate, and the pulp broadens from the base forwards for the first third of the length, at this point there are two large papillæ, thence onwards it narrows markedly, and forms two anteriorly rounded terminal lappets. The conical accessory lips are 0·15 mm. in length; the œsophagus has a length of 4 mm.; the vulva lies in the ventral line a little in front of the middle of the body, and the anterior region thus marked off bears to the posterior portion the proportion of 23 to 25. The anus lies 0·3 mm. from the tail end; the extreme point of the tail is produced into a minute finger-shaped point, 0·048 mm. in length.

There can be no doubt that this species is indeed parasitic, for there are no known free-living Ascarids in which the structural features entirely correspond to those of parasitic forms.

Schneider[1] describes the following Ascarids, in which the lips bear tooth plates and accessory lips are developed:—*Ascaris depressa* from *Vultur fulvus*, and *Ascaris ensicaudata* from singing birds (with upper lips, and with a mouth aperture exhibiting anterior processes quite different from the above), *Ascaris rubicunda* from *Python molurus*, and *Ascaris radiosa* from *Echidna rhinocerotis* (with the anterior processes quadrangular), *Ascaris quadrangularis* from *Crotalus*, *Ascaris holoptera* from *Testudo græca*, and *Ascaris sulcata* from *Chelone midas* (with the upper lip forming a quadrangular aperture).

I have previously described[2] the following related species:—The above-mentioned *Ascaris ensicaudata*, Zed. (=*Ascaris cornicis*, Gmel., *Ascaris crenata*, Zed., *Ascaris heteromera*, Crepl., *Ascaris semiteres*, Zed.), from *Turdus*, *Sturnus*, *Corvus*, *Salicaria*, *Vanellus*, *Himantopus*, *Œdicnemus*, *Charadrius* (with an upper lip, with the maximum

[1] *Loc. cit.*, pp. 40–44, tab. i. figs. 6, 7, 8, 9, 10, 11, 12.

[2] *Archiv f. Naturgesch.*, Jahrg. l. Bd. i., 1884, pp. 125–127, pl. vii. figs. 1–3.

breadth in the anterior third, and with two lobes with large pointed processes on the anterior part of the pulp: *Ascaris gallinulæ* and *Ascaris philomelæ* from *Gallinula chloropus* and *Luscinia philomela*[1] (probably to be united with *Ascaris ensicaudata*); *Ascaris spiralis*, Zed.,[2] from *Bubo maximus* and other Owls (with an upper lip, with the finger-shaped, anterior, terminal lobes of the pulp converging inwards, and not expanding outwards). In *Ascaris microcephala*, Rud.,[3] from *Ardea comata*, the accessory lips are as long as the principal lips, the upper lip and its aperture are quadrangular.

It would thus appear that the Challenger form described above is a new species, and it is to be regretted that the host—doubtless some marine Vertebrate—is unknown.

4. *Ascaris diomedeæ*, n. sp. (Pl. I. figs. 12, 13).

Specimen labelled: "From the stomach of *Diomedea brachyura*, No. 344, June 1875." The vessel contained two specimens. The length measured 35, the breadth 0·78 mm.; the wrinkling of the cuticle is 0·013 mm. broad; the contour of the body is saw-like. The lips bear tooth-plates, and there are no accessory lips. The upper lip is broad and inconspicuous, and rounded off laterally. It exhibits anteriorly a small round protrusion, and to the inside of the latter a projection with tooth-plates. At a distance of 0·49 mm. from the end of the body, to right and left in the lateral lines are two large, semiconical nuchal papillæ, measuring 0·046 mm. The œsophagus lies rather towards the dorsal side, and at its passage into the intestine bends round at right angles, extending backwards along the ventral side. At the point of union with the intestine a cæcum is given off, 0·12 mm. in breadth. This extends forwards on the ventral side of the œsophagus for 1·8 mm., while a second and broader, 0·24 mm. in diameter anteriorly, runs backwards for 2·7 mm. along the dorsal surface of the intestine. The œsophagus occupies $\frac{1}{13}$, the rounded tail $\frac{1}{224}$ of the total length. The specimens are not sexually mature.

Ascaris arctica, von Linstow,[4] from the Kiel Zoological Museum, discovered in *Diomedea leucops*, in the North Pacific, bears no resemblance to the form described above from *Diomedea brachyura*, Temm.[5] The upper lip is semicircular with an anterior point, the œsophagus is proportionately much larger, for it occupies $\frac{1}{8·6}$ of the entire length. The upper lip of *Ascaris diomedeæ* most resembles that of *Ascaris tiara*, von Linstow,[6] from *Varanus ornatus*, in which the œsophagus occupies $\frac{1}{4·3}$ of the entire length. The differences in the structure of the head make a union of the two forms impossible, and the two hosts also certainly hint at two distinct species.

[1] *Württemb. naturw. Jahresh.*, xxv., 1879, pp. 321, 322, pl. v. figs. 4, 5.
[2] *Archiv f. Naturgesch.*, Jahrg. xli. Bd. i., 1875, pp. 203, 204, pl. iv. figs. 30, 31, A.
[3] Von Linstow, *op. cit.*, Jahrg. xlix. Bd. i., 1883, pp. 276, 277, pl. iv. figs. 1, 2.
[4] *Archiv f. Naturgesch.*, Jahrg. xlvi. Bd. i., 1880, p. 42, pl. iii. figs. 2, 3.
[5] Report on the Birds, Zool. Chall. Exp., part viii. pp. 147, 148.
[6] *Württemb. naturw. Jahresh.*, 1879, p. 320, pl. v. fig. 1.

5. *Ascaris macruri*, n. sp. (Pl. I. figs. 10, 11).

Specimen labelled : " Ascarides of large *Macrurus rudis*, 15 July 1874. Depth, 600 fathoms. Station 171.

" When the specimen of Macrurus was placed in a tub of water, the two Ascarides came from it."

The glass contained two specimens, 140 and 94 mm. in length, and 2 mm. in breadth. The body is straight and stretched. There was no noticeable elastic tension of the cuticle, such as was observed (see below) in a species of Nematode from the great depths. The animal is, of course, protected from a greater pressure of water by the body of the host in which it lives. Both specimens were females. The cuticle is transversely wrinkled at intervals of 0·04 mm. The lips are without tooth-plates, but with accessory pieces, and exhibit on their outer margins indentations or "spoons." The upper lip is quadrangular, with anteriorly rounded corners ; the anterior third is expanded, and measures 0·25 mm. in breadth by 0·23 mm. in length. The spoon-like indentations are found posteriorly on the two posterior thirds. The blunt, anteriorly rounded accessory pieces measure four-sevenths of the length of the main lips. The œsophagus measures $\frac{1}{19}$ of the entire length. The tail end becomes suddenly narrower about 2 mm. from the point, so that the end has a general styliform shape, with a sharp needle-like point. The thicker portion stands at a right angle to the thinner part. The anus opens on the projecting portion. The ova are spherical, the shell is separated by a marked interval from the yolk, and measures 0·0049 mm. in breadth. The ovum has a diameter of 0·085, and the yolk of 0·062 mm.

Helminths have never before been observed in *Macrurus*, and it is to be regretted that of this remarkable species of *Ascaris* only two female specimens were obtained, as the characters of the male would have been of much interest.

6. *Ascaris macruroidei*, n. sp.

This Nematode was contained in a tube labelled "From the stomach of large Macrurid. Station 147. Date 30 Dec. 1873. Lat. 46° 16′ S., Long. 48° 27′ E. Depth 1600 fms." There were three fragments, one anterior and two posterior extremities; of 27, 34, and 55 mm. length, and 0·66 to 1·06 mm. breadth. Since one anterior and one posterior part have exactly the same breadth, they probably belong to the same specimen, which would thus have a total length of 82 mm. Transverse wrinkles of the cuticle could not be perceived. The lateral ridges have a breadth of 0·18 mm. and are marked at the right and left side by two longitudinal rows of large cells with a diameter of 0·036 mm., containing a bright, round nucleus, which is 0·012 mm. in diameter. There

are three lips with accessory lips without dentigerous ridges; the accessory lips have two-thirds of the dimensions of the principal lips. The upper lip is oval with truncated base; it has a breadth of 0·26 mm. and a length of 0·29 mm., the base of 0·18 mm., the pulp has on the outside two rounded processes, to the outer sides of which are placed two large papillæ; the inside of the lip shows two reniform protrusions, surmounting the lip anteriorly. Two slightly prominent nuchal papillæ are situated 1·5 mm. from the

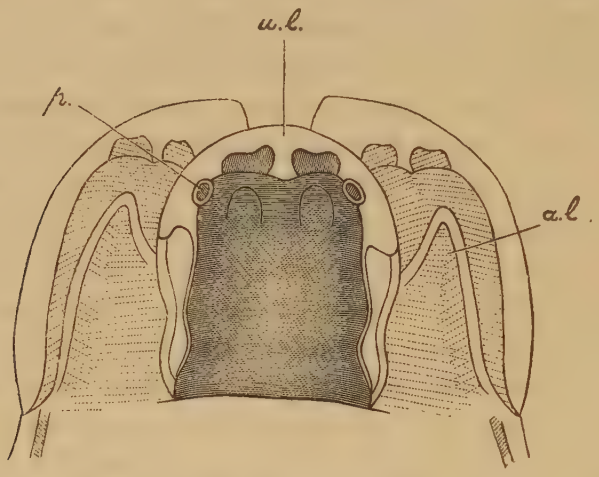

Fig. 1.—Cephalic end of *Ascaris macruroidei*, n. sp., from the dorsal surface; *u.l.*, upper lip; *p.*, papilla; *a.l.*, accessory lip.

anterior end, their stalks piercing the cuticle. The œsophagus has a length of 5·5 mm., and the tail has a length of 0·68 mm. and is conically pointed.

The specimens are females, not yet sexually mature.

The species is without any doubt different from *Ascaris macruri*, as is shown by a comparison with this form.

7. *Filaria* (*Spiroptera*) *cirrohamata*, n. sp. (Pl. I. figs. 14–16).

Specimen labelled: "*Ascaris* from the stomach of *Phalacrocorax verrucosus*, &c.; along with *Ascaris spiculigera*."

Two specimens were obtained, a male and a female.

The wrinkling of the skin is 0·006 mm. broad; the head end exhibits two conical lips, and short, rudimentary neck frills. The first quarter of the œsophagus is somewhat narrower than the remaining portion, which is exceptional in being without any glandular coating. At a distance of 0·14 mm. from the head, the lateral line exhibits a three-pointed nuchal papilla.

The male is 7·58 mm. in length, and 0·25 mm. in breadth, the very long œsophagus measures somewhat less than half the entire length, while the tail occupies $\frac{1}{20}$ of the same.

The tail end is rounded off and exhibits a broad bursa. On the ventral surface on each side there are 4 pre- and 5 post-anal, long-stalked papillæ, and between the third and fourth post-anals there is a large interspace. The cirri are very unequal; the smaller and thicker is 0·14 mm. in length; the larger and narrower measures 0·6 mm., and bears a terminal process projecting at right angles.

The female measures 9·72 mm. in length, and 0·35 mm. in breadth; the œsophagus occupies $\frac{1}{27}$ of the total length; the conical-pointed tail $\frac{1}{81}$. The vulva lies far forward just in front of the passage of the œsophagus into the intestine. The very thick-shelled ova are 0·039 mm. in length, and 0·019 mm. in breadth. Similarly three-pointed nuchal papillæ are exhibited by the following forms:—*Filaria squamata*, von Linstow,[1] from the intestines of *Phalacrocorax carbo* (with conspicuous neck fringes, and very short ($\frac{1}{288}$) tail, *Filaria involuta*, von Linstow,[2] from the skin of the stomach of *Strix flammea*, also with marked neck fringes, *Filaria* (*Dispharagus*) *laticeps*, Rud.,[3] from *Falco*, *Strix*, *Ægolius* (also with neck fringes), *Filaria tridentata*, von Linstow,[4] from *Colymbus arcticus* (with nuchal papillæ of a different form, and with the œsophagus occupying only $\frac{1}{7}$ of the total length), *Filaria triænucha*, Wright,[5] from *Ardea minor* (only known as a female with ova, 0·027 mm. in length, and 0·018 mm. in breadth). In these five species the fish-hook like process of the longer cirrus is absent.

The latter is exhibited by *Filaria hamata*, von Linstow,[6] from *Astur nisus*, a species with strongly developed neck fringes, and by *Filaria penihamata*, Molin,[7] from *Strix albomarginata*, *Strix atricapilla*, *Strix flammea*, and *Strix griseata*, which has only two post-anal papillæ on either side.

8. *Filaria flabellata*, n. sp. (Pl. II. figs. 1–5).

Specimen labelled: "*Filaria sub cute et in cav. abdom.* of *Paradisea apoda*, from Aru Islands."

The specimens were all burst, and in part torn. The body is short and compressed; the two ends of the body are rounded off, and not narrowed. The breadth averages 1·08 mm., and bears a ratio of 1 : 14–15 to the length. The mouth cavity is supported on each side by tripartite, fern-shaped, chitinous plates, measuring 0·21 mm., and rounded off at the corners. The œsophagus measures $\frac{1}{114}$ of the total length.

[1] *Archiv f. Naturgesch.*, Jahrg. xlix. Bd. i., 1883, pp. 287, 288, pl. vii. figs. 18, 19.

[2] *Württemb. naturw. Jahresh.*, xxxv., 1879, pp. 323, 324, pl. ii. fig. 7.

[3] Schneider, Monographie der Nematoden, pp. 93, 94, pl. vi. fig. 3; von Drasche, *Verhandl. d. k. k. zool.-bot. Gesellsch. Wien*, 1883, p. 209, pl. xiv. fig. 2.

[4] *Archiv f. Naturgesch.*, Jahrg. xliii. Bd. i., 1877, pp. 10, 11, pl. i. fig. 17.

[5] Contributions to American Helminthology, Toronto, 1879, pp. 21, 22, pl. i. fig. 16.

[6] *Archiv f. Naturgesch.*, Jahrg. xliii. Bd. i., 1877, pp. 11, 12, pl. i. fig. 19; Jahrg. xlv. Bd. i., 1879, p. 172, pl. xi. fig. 17.

[7] Von Drasche, *Verhandl. d. k. k. zool.-bot. Gesellsch. Wien*, 1883, Bd. xxxiii. pp. 198, 199, pl. xiii. fig. 6.

The male is 13 to 16 mm. in length; the tail end occupies $\frac{1}{189}$ of the total length; the two cirri are of equal breadth, and measure 0·72 and 0·86 mm. in length; the shorter has a bow-shaped curvature in the middle, and the longer is sabre-shaped; in front of the cloaca there are on each side four very small, scarcely perceptible papillæ. The female measures 29 to 31 mm.; the tail end occupies only $\frac{1}{1231}$ of the total length; the vulva lies very far forward, only 0·6 mm. distant from the head end. The ova are elliptical and very thick shelled; the shell is 0·0066 mm. in thickness; the ova are 0·049 mm. in length and 0·031 mm. in breadth.

This *Filaria* was found by R. von Willemoes Suhm, who died on the Challenger Expedition. He has referred to it in the following lines:[1]—"Under the skin and on several positions in the abdominal cavity I found free *Filariæ*, such as not unfrequently occur in our crow-like birds. There were no other Helminths in the intestine. This is probably the first time that any one has examined fresh Birds of Paradise in search for Helminths, and the case is on that account worth noting, since the beautiful creature is always mentioned in the first rank of birds, although it is in reality nothing more than 'a crow developed by sexual selection.'"

Five species of *Filaria* are known in which the mouth exhibits a chitinous armature similar to that of the above form.

Filaria tricuspis, Fedtschenko,[2] from *Corvus cornix*, which is very similar to the above species, but has larger cirri, which measure 1·6 and 1·2 mm. in length, while the chitinous plates on the head are smaller, attaining a length of only 0·12 mm. The total length is, however, much greater, for the female is 150 mm. in length. *Filaria ecaudata*, Oerley,[3] from *Lamprotornis aeneus*, is very probably identical with *Filaria tricuspis*, *Filaria obtusa*, Rudolphi[4] (*non* Schneider), from *Hirundo rustica*, *Hirundo urbica*, and *Hirundo riparia* has its breadth and length in the proportion of 1 : 80, and the shorter spicule is twice as broad as the longer.

Filaria pungens, Schneider,[5] has numerous large papillæ on the tail end of the male, and was found in *Turdus cyaneus*.

The unnamed *Filaria* found by Parona[6] in *Buceros nasutus* was a female, so that comparison is impossible.

It is remarkable that these species, which resemble one another so closely, were all found in Birds.

[1] Challenger Briefe von R. v. Willemoes Suhm, Leipzig, 1877, pp. 127, 128; *Zeitschr. f. wiss. Zool.*, Bd. xxvi. p. lxii., 1875.

[2] *Soc. Nat. Hist. Moscow*, x. pp. 10–11. Von Linstow, *Archiv f. Naturgesch.*, Jahrg. xlix. Bd. i., 1883, p. 285, pl. vii. fig. 16.

[3] Oerley, Report on the Nematodes in the possession of the British Museum, *Ann. and Mag. Nat. Hist.*, ser. 5, vol. ix. pp. 312, 313, pl. x. figs. 1 *a–d*, 1882.

[4] Dujardin, Hist. Nat. des Helminthes, pp. 53–54, pl. iii. fig. J, 1–2.

[5] Monographie der Nematoden, pp. 92, 93, pl. vi. fig. 2.

[6] Di alcuni elminti raccolti nel Sudan orientale, Genova, 1885, pp. 433, 434, pl. vii. fig. 14.

9. *Filaria paradiseæ*, n. sp. (Pl. II. figs. 6, 7).

From *Paradisea apoda*, Aru Islands, in the same tube as *Filaria flabellata*.

There is only one specimen—a male, which measures 19·2 mm. in length and 0·38 mm. in breadth, the proportion of breadth and length being thus 1 : 52. The body is decidedly elongated, narrowing rapidly after the head. The latter bears two small round lips. The œsophagus occupies $\frac{1}{20}$ of the entire length, and is 0·036 mm. in breadth; the tail portion measures only $\frac{1}{116}$ of the whole. The cuticle is distantly wrinkled. The tail end is rolled up in a spiral, and is on that account very difficult to study. One cylindrical spicule (0·098 mm. long by 0·049 mm. broad) was visible; a second was not to be found. The very end is conically rounded. I was not able to study exactly the nature of the papillæ on the tail, since it was impossible to unroll the coil, or to place the object with the ventral surface directed upwards. Only this could be certainly demonstrated, that the above form is not identical with *Filaria flabellata*. An exact diagnosis was impossible with such scanty material.

10. *Prothelmins profundissima*, n. gen., n. sp. (Pl. II. figs. 8–10).

Specimen labelled: "3 March 1874. Depth 1950 fathoms."

The vessel contained two Nematodes, 58 and 65 mm. in length, 0·9 and 0·96 mm. in breadth respectively. The colour is yellowish, but the alimentary canal shines through as a blackish tract on the dorsal surface. Both extremities of the body are rounded, the posterior somewhat broader. The anus is situated 0·35 or 0·43 mm. from the tail end; the latter occupies $\frac{1}{151}$ of the entire length. The œsophagus measures in one specimen 1·42 mm., the other 1·62 mm., and thus occupies about $\frac{1}{40}$ of the total length. Both head and tail ends are entirely devoid of papillæ, or other normal characteristics.

The cuticle is very firm and thick, measuring 0·084 mm. in transverse section, and consists of two systems of fibres crossing at an angle of 55°. The individual fibres are 0·0025 mm. in breadth. The cuticle is covered externally by a hyaline epidermis, 0·0033 mm. in thickness.

Below the cuticle is a muscular layer, 0·02 mm. in breadth. It belongs to the Holomyarian type as defined by Schneider, and consists of longitudinal fibres, with an average breadth of 0·013 mm. Each fibre exhibits a row of vacuoles and a system of transverse striæ. In transverse sections the fibres lie with the long diameter of their spindle-shaped cross section disposed obliquely to the surface of the cuticle, and the vacuoles appear as dark median points. No interruption of the muscular sheath by lateral, dorsal, or ventral ridges was to be observed.

The body-cavity is filled by the alimentary canal, which is attached to the dorsal

surface of the body-wall. It is coloured black by pigment balls, 0·002 mm. in size. The cavity also contains a colourless, partly granular, partly hyaline, protoplasmic mass.

No reproductive organs were developed.

The internal wall of the musculature bears a simple layer of non-nucleated cells.

The slightest injury to the animal causes the epidermis to roll up, and the same happens to a less extent with the cuticular fibres, and still less with the muscles. This is not to be wondered at when we remember the enormous pressure to which the animal is subjected at a depth of 11,000 to 12,000 feet. All elastic membranes and fibres roll up when suddenly relieved from a great pressure or strain to which they have been subjected. The very firm and hard cuticle can obviously bear a great pressure. The species appears to spend its entire life free, for the head end exhibits no boring apparatus by which the worm might penetrate the organs of other animals. The specimens are all without reproductive organs, and may be described as larval. They are the largest free-living Nematode larvæ as yet known, and the adult form must be one of the largest free-living Nematodes.

It is unfortunate that no sexually mature specimens were found, as they could not but have exhibited peculiarities, probably more marked than those which make even the larvæ interesting.

The most closely related genera are *Gordius* and *Mermis*, which are, however, destitute of an anus, and parasitic in their larval life. The musculature of the above-described genus is markedly peculiar, and quite different from that observed in other Nematodes.

B. CESTODA.

11. *Tænia clavulus*, n. sp. (Pl. II. figs. 11, 12).

Specimen labelled: "*Tænia* from intestine of *Ptilorhis alberti*, Cape York."

The vessel contains numerous fragments of *Tæniæ*, which probably belong to two specimens, and also the anterior portion of a proglottis chain with the attached scolex. The latter is oval, 0·84 mm. long by 0·6 mm. broad, the suckers are elongated (0·3 mm.), situated on the anterior third of the scolex, and exhibit firm, prominent, almost contiguous margins. The apical surface of the scolex bears a smaller fifth sucker, 0·084 mm. in diameter, armed with a double row of nail-shaped rods. These have not the usual form of *Tænia* hooks, are very small (only 0·011 mm.), and number about sixty. The first proglottides measure 0·29 mm. in breadth and 0·048 mm. in length; the last are 1·1 mm. broad and 0·72 mm. long. The segmentation begins about 0·9 mm. behind the scolex.

Helminths have not been previously observed in *Ptilorhis alberti*, Elliot.[1]

[1] Report on the Birds, Zool. Chall. Exp., part viii. p. 87.

The nail or thorn-shaped armature of the fifth sucker recalls that of *Tænia australis*, Krabbe,[1] but in the latter they form the apparatus of attachment of the four large suckers. The suckers are also armed with spines in *Tænia friedbergeri*, von Linstow, from *Phasianus colchicus*; *Tænia frontina*, Dujardin, from *Picus viridis*; and *Tænia infundibuliformis*, Goeze, from *Gallus domesticus*.

12. *Tænia increscens*, n. sp. (Pl. II. figs. 13, 14).

Specimen labelled: "*Tænia* from *Hæmatopus unicolor*,[2] from Hardy Bay, New Zealand."

Of this form there is only one specimen, which measured 54 mm. in length. The scolex is pear-shaped, 0·6 mm. long and 0·4 mm. broad. The apex bears a small pear-shaped rostellum, not armed with hooks. The suckers which lie in the anterior third of the scolex are spherical, and have a small aperture directed forwards. The so-called neck is in comparison very thin and delicate, and measures 0·11 mm. in breadth. At a distance of 6 mm. from the scolex the body suddenly expands, increasing both in breadth and thickness. Directly behind the scolex the limy bodies in the proglottides begin to appear. The first proglottides are 0·06 mm. long and 0·3 mm. broad; the last are 0·54 mm. long, 2·5 mm. broad, and 1·5 mm. thick. In the last proglottides the formation of ova has begun, but no mature ova are yet developed. The ova are apparently spherical, and have two envelopes, of which the outer measures 0·066 mm., and the inner 0·046 mm., while the oncosphere measures 0·033 mm.

13. *Tænia diomedeæ*, n. sp. (?).

Specimen labelled: "Tæniodes from Stomach of *Diomedea brachyura*,[3] No. 244, 28th June 1873, Pacific."

The vessel contains seven specimens and several fragments. In none, however, was the scolex present. The same vessel contained a specimen of *Tetrabothrium torulosum*, mentioned below.

No final designation is possible, since the absence of scolex implies the absence of diagnostic characteristics. The maximum length was 250 mm.; the anterior proglottides are 0·58 mm. in breadth, and 0·12 mm. in length; while those furthest back measure 1·9 by 0·78 mm. The development of the male reproductive organs begins about 120 mm. from the anterior end. The cirri occur on one side. The ova are not yet developed.

This form is, perhaps, identical with *Tænia sulciceps*, Baird,[4] which is found in *Diomedea exulans*, but the absence of the scolex leaves this undecided.

[1] Bidrag til Kundskab om Fuglenes Bændelorme, *K. dansk. Vidensk. Selsk. Skriv.*, 5 R. Bd. viii. pp. 95, 96, pl. x. figs. 296–293.

[2] *Hæmatopus unicolor, jr.* (?), Report on the Birds, Zool. Chall. Exp., part viii. p. 115.

[3] *Diomedea brachyura*, Temm., *op. cit.*, pp. 147, 148.

[4] *Proc. Zool. Soc. Lond.*, 1859, p. 111; *Ann. and Mag. Nat. Hist.*, ser. 3, vol. iv. p. 240, 1859.

14. *Tænia trichoglossi*, n. sp. (?) (Pl. II. fig. 15).

Specimen labelled : "*Tænia* from intestine of *Trichoglossus swainsoni*,[1] from Cape York, Australia."

The vessel contained nine fragments of a *Tænia*, but without a scolex. The most anterior proglottides are 0·18 mm. in length, and 0·84 mm. in breadth, while those furthest back are 1·1 mm. long by 2·1 mm. broad. The largest fragment measures 80 mm., and the chain of proglottides has a wreath-like form. The specimens possibly belong to *Tænia leptosoma*, Diesing, found in various Parrots. The ova are spherical, and have two transparent sheaths, of which the outer measures 0·036 mm., and the inner 0·026. The oncosphere has an elliptical contour, and measures 0·023 mm. in length by 0·018 mm. in breadth.

15. *Tetrabothrium torulosum*, n. sp. (Pl. II. figs. 16, 17).

This form was in the same tube as *Tænia diomedeæ;* its locality of occurrence was therefore the stomach of *Diomedea brachyura*, Temm. The vessel contained three specimens and four fragments. The length of the largest animal was 175 mm., the breadth 0·84 mm., increasing to 5 mm. posteriorly, with a thickness in the same region of 2 mm. The scolex is 1 mm. in breadth, and 0·96 mm. in length. No proglottides are recognisable, but the body exhibits close folds about 0·12 mm. in length. The body is very compact. The intact adult must be very long, for even in the posterior portion of the not inconsiderable length, no mature ova are to be seen. One only finds spherical balls, 0·023 mm. in diameter, from which the ova probably develop. The large scolex exhibits on both ventral and dorsal surface a pair of three-cornered suckers surrounded by strongly developed coiled pads. The lateral lines also exhibit strong protrusions, and further back there is a second pair. The folding of the body is characteristic of *Tetrabothrium*, and so is the form of the scolex and suckers.

16. *Tetrabothrium auriculatum*, n. sp. (Pl. II. figs. 18–20).

Specimen labelled : "*Tænia* from the intestines of *Thalassœca glacialoides*,[2] February 22, 1874, Antarctic Ocean ;" and also specimen labelled : "*Tetrabothrium* from *Daption capensis*,[3] October 10, 1873, South Atlantic."

The animal attained a length of 112 mm. The scolex is 0·48 mm. in breadth, and 0·34 mm. in length. The four powerful suckers occupy almost the whole of the scolex, and each exhibits anteriorly and externally a round, ear-shaped protrusion. The apex bears a round protrusion, while the ventral and dorsal surfaces show on either side three

[1] *Trichoglossus swainsoni*, Gould, Report on the Birds, Zool. Chall. Exp., part viii. p. 90.
[2] *Thalassœca glacialoides*, Smith, *op. cit.*, p. 142.
[3] *Daption capensis*, Linn., *op. cit.*, p. 144.

small apertures, which appear to be the openings of the water vascular system. At a distance of 0·6 mm. behind the scolex the segmentation begins. The first proglottides are 0·012 mm. long and 0·41 mm. broad, those in the middle are 0·29 mm. by 1·64 mm., while those furthest back measure 0·42 mm. in length by 2·5 mm. in breadth. Immediately behind the scolex calcareous bodies begin to appear. They are found even in that part of the former which is in direct connection with the proglottis. The generative apertures occur on one side, not however quite marginally, as in the *Tæniæ*, nor yet in the median line of the joint surface as in *Bothriocephali*, but in the anterior third of the proglottis at a distance of 0·066 mm. from the margin. The cylindrical cirrus is protruded to a length of 0·082 mm., and is 0·016 mm. in breadth. In *Thalassœca* and *Daption* no Helminths have been previously observed, and in the related genera, such as *Diomedea* and *Procellaria*, no *Tetrabothria*.

Survey of Helminths in Relation to their Hosts.

	Host.	Name of Helminth.	Organ of Occurrence.
Mammal.	*Otaria jubata*, . . .	*Ascaris simplex*, . .	stomach.
Bird.	*Trichoglossus swainsoni*, .	*Tænia trichoglossi.*	
,,	*Ptilorhis alberti*, . .	*Tænia clavulus*, . .	stomach.
,,	*Paradisea apoda*, . .	*Filaria paradiseæ.*	
,,	*Paradisea apoda*, . .	*Filaria flabellata*, . .	below skin and in abdominal cavity.
,,	*Hæmatopus unicolor*, .	*Tænia increscens.*	
,,	*Phalacrocorax verrucosus*,	*Filaria cirrohamata*, .	stomach.
,,	*Phalacrocorax verrucosus*, .	*Ascaris spiculigera*, . .	stomach.
,,	*Thalassœca glacialis*, .	*Tetrabothrium auriculatum*,	stomach.
,,	*Daption capensis*, . .	*Tetrabothrium auriculatum.*	
,,	*Diomedea brachyura*, .	*Ascaris diomedeæ*, . .	stomach.
,,	*Diomedea brachyura*, .	*Tænia diomedeæ*, . .	stomach.
Fish.	*Macrurus rudis*, . .	*Ascaris macruri.*	
,,	*Macrurus* sp. (?) . .	*Ascaris macruroidei*, .	stomach.
	Unknown, . . .	*Ascaris biloba.*	
	Free in deep sea, . .	*Prothelmins profundissima.*	

APPENDIX.

Representatives of the Acanthocephala, Trematoda, and Gordiacea are not totally wanting in the Challenger collection, but there were none among the specimens sent to me, because only a few very delicate larval forms were discovered, and these had already been described by the authors who treated of their hosts. In the Reports already published the following species are mentioned, for the knowledge of which I have to thank Mr. John Murray.

C. ACANTHOCEPHALA.

Echinorhynchus corrugatus, Sars.

Echinorhynchus corrugatus, G. O. Sars, Report on the Schizopoda, Zool. Chall. Exp., vol. xiii. part xxxvii. pp. 221, 222, pl. xxxviii. figs. 15–18.

A large larval form, that occurs in the cavity of the abdomen of *Euphausia pellucida*, Dana.

D. TREMATODA.

Distomum filiferum, Sars.

Distomum filiferum, G. O. Sars, *op. cit.*, p. 222, pl. xxxviii. figs. 19–23.

Larva from the abdominal cavity of *Nematoscelis megalops*, Sars, and *Thysanoëssa gregaria*, Sars.

Distomum glauci, Bergh.

Distomum glauci, Bgh., Report on the Nudibranchiata, Zool. Chall. Exp., vol. x. part xxvi. p. 18, pl. x. figs. 5–17.

Distomum glauci, Bgh., K. dansk. Vidensk. Selsk. Skrift., R. 5, Bd. vii., 1864, pp. 282–283.

This species was found in *Glaucus glacialis*, Bergh, and *Glaucus longicirrus*, Rhdt., and in the Challenger expedition it was discovered by the same author in *Glaucus atlanticus*, Forster, and described and figured. It also is a larval form, and destined to attain its definitive sexual development in some other animal.

E. GORDIACEA.

Dr. R. v. Willemoes Suhm mentions in his letters from the Challenger[1] a *Gordius* found in a Crab dredged near New Zealand and another in an Orthopteron without wings from the same island, where species of *Gordius* are also said to be very common in water.

[1] Challenger Briefe, pp. 103, 107.

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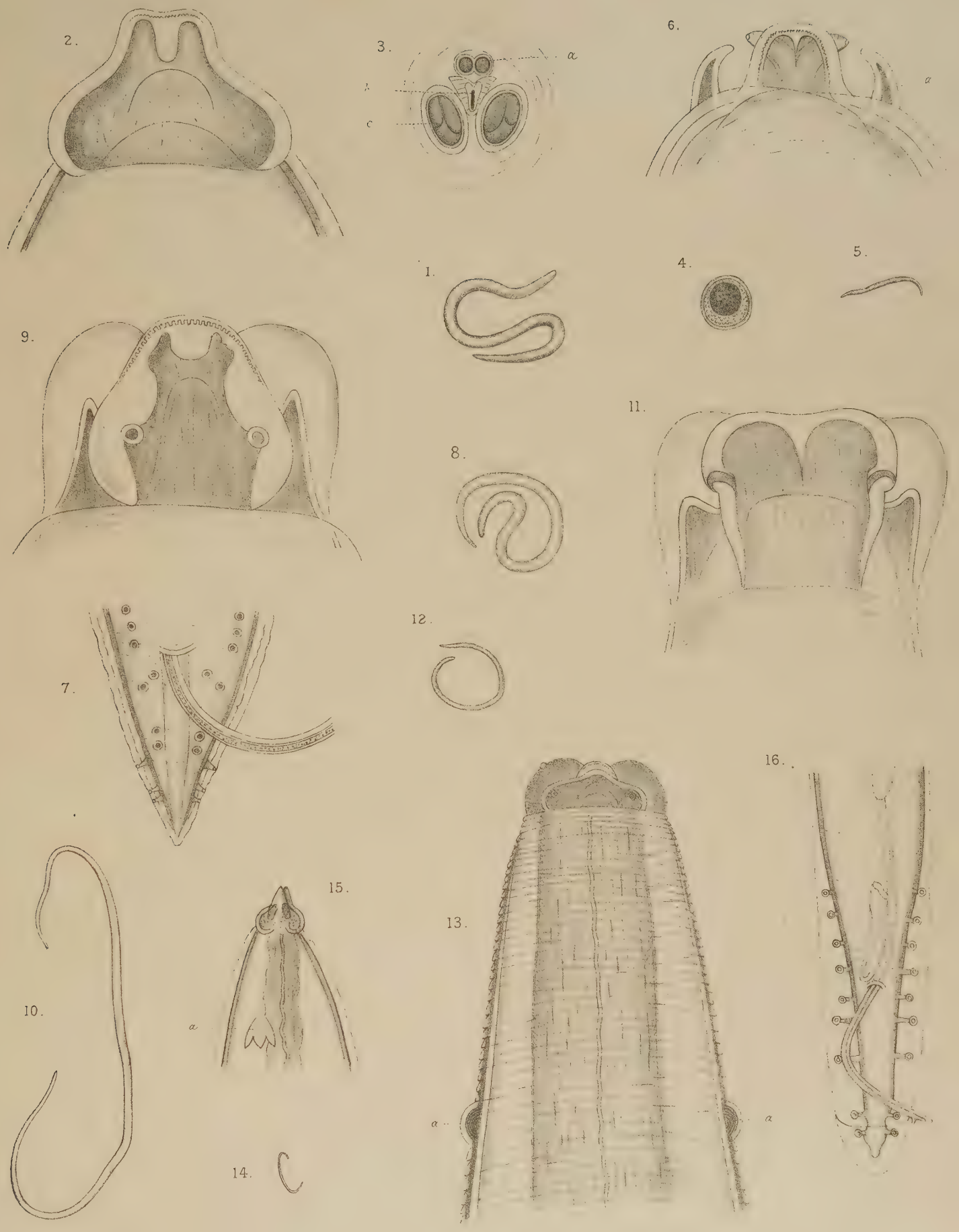

F.Huth, Lith^r Edin^r

1-4. ASCARIS SIMPLEX, Rud. 5-7. ASCARIS SPICULIGERA, Rud. 8, 9. ASCARIS BILOBA, n. sp.
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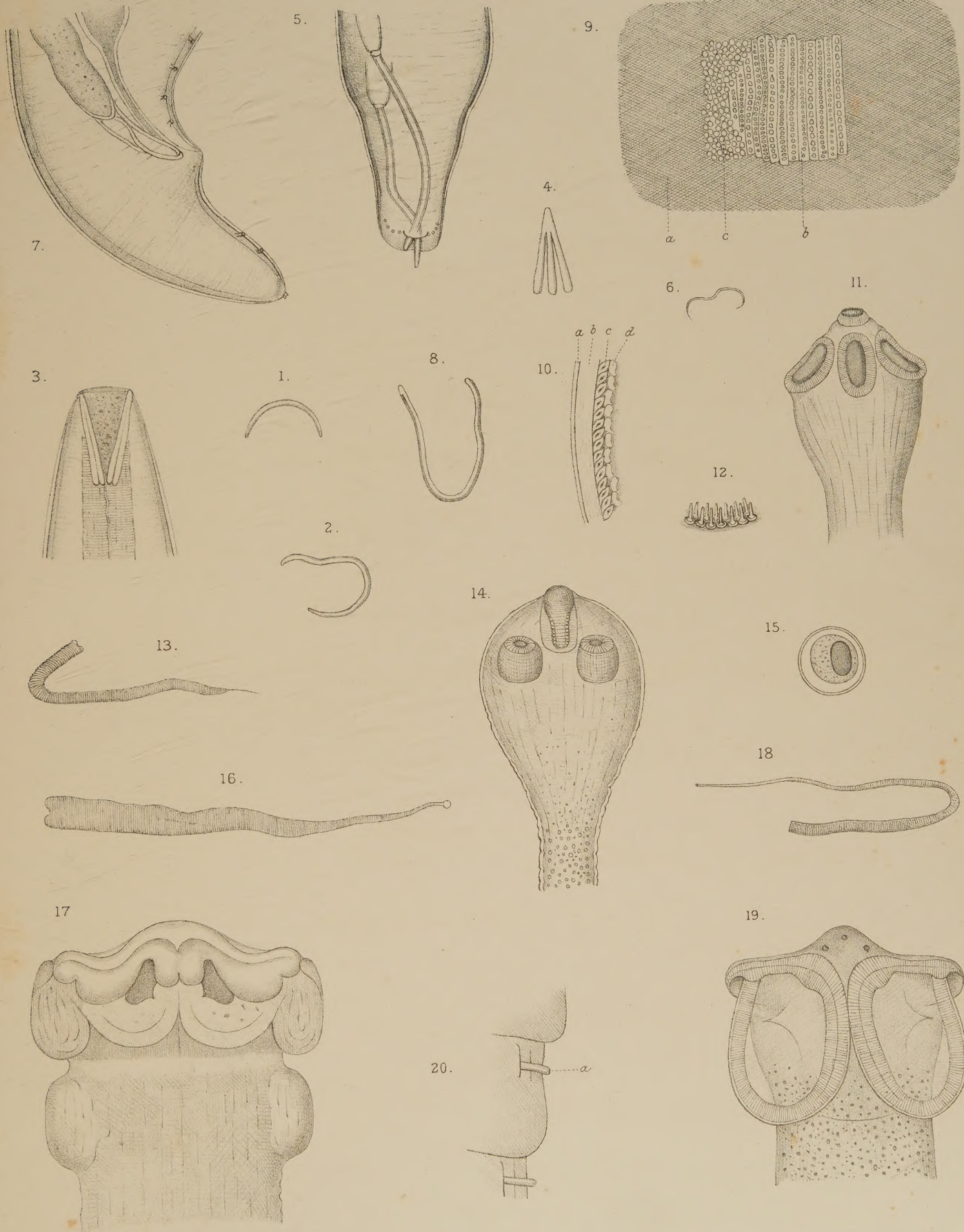

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1-5. FILARIA FLABELLATA, n. sp. 6, 7. FILARIA PARADISEÆ, n. sp. 8-10. PROTHELMINS PROFUNDISSIMA, n. gen., n. sp.
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